

were flattened, and were from five to seven inches in circumference, and the area in which they fell was some ten or twelve miles north and south and six or seven miles east and west. A severe wind and hail storm was also reported at Humboldt and Mason, Tenn., on the 24th. At the first-named place the storm occurred at 6.30 p. m.; it came from the southwest, and the hail-stones were the size of hickory nuts. At Mason the storm occurred shortly after noon, and lasted about fifteen minutes, and some of the hail-stones were one inch in diameter. At Lexington, Ky., the wind attained an extreme maximum velocity of ninety-six miles per hour at 4.45 p. m., after which the wind increased in force, but no record could be made. On the 25th a storm passed over Gainesville, Tex., destroying several buildings. The storm was reported the most destructive that had visited that place in years. A storm from the southwest also passed over Brownsville, Tenn., on the 25th, causing damage to the amount of about \$50,000. At 3.30 p. m. of the 26th a wind storm, accompanied by hail, caused great damage to property at Marksville, La. On the same date a very destructive storm swept over Johnsonville, Tenn., and a

storm destroyed a number of buildings near Paducah, Ky. On the night of the 27th a violent wind storm visited Needmore, a small town near Talladega, Ala., doing considerable damage to property and injuring several persons. The storm swept parallel with the track of the heavy storm of twenty-two years ago, passing about two miles south of the latter; its track was strewn with timber, fragments of furniture, and household goods; large trees were twisted off at the ground, and planks and heavy timber were driven into the ground with the force of a pile-driver. On the same date a heavy storm from the southwest passed three miles south of Carrollton, Ala., at 7.30 p. m. The storm displayed the characteristics of a whirlwind; trees that had been uprooted or broken off were scattered in every direction along its path; one man was killed and several injured. But few houses were situated in its path, otherwise the damage would have been greater. Another severe storm passed about fifteen miles north of Carrollton on the same day; a destructive storm from the southwest passed through Kemper county, Mississippi, at 5 p. m.; and at night a storm caused great damage at Benton, Yazoo Co., Miss.

INLAND NAVIGATION.

ICE IN RIVERS AND HARBORS.

Lake Erie remained open during the month, and but little ice was reported in Lake Huron. The Signal-Service observer at Buffalo reports that navigation could have been continued at the west end of Lake Erie throughout the winter. At the close of the month Thunder Bay and Thunder River were partly covered with ice. On the 28th steamers commenced to make regular trips from Detroit, Mich., to Cleveland, Ohio. This was the earliest opening of navigation on record at the port of Detroit. On the 6th the ice ran out of the Mississippi River at Davenport, Iowa.

FLOODS.

Owing to the rapid melting of snow which had formed in drifts fifteen to twenty feet deep in the hills and mountains of Oregon, and the excessive rains of the last of January and the first part of February, the streams in western Oregon rose rapidly, and the loss by flood in the state is estimated at not less than \$1,000,000. At Portland, Oregon, the Willamette River reached 28.7 feet on the gauge at 8 p. m. of the 5th, which was the highest point ever recorded at that place; railroad communication was cut off, and a greater part of the city was under water to a depth of two to four feet. In southern Oregon disastrous floods occurred along the Rogue River and its tributaries. The Sacramento River overflowed its banks at Red Bluff, Cal., damaging property, and in the valleys of the Eel and Mad rivers the bottom lands were flooded, and bridges, stock, and houses were carried away. Portions of Eureka, Cal., also sustained damage by flood. Considerable damage was reported near Los Angeles, Cal., by the Los Angeles River changing its course just south of that city and inundating a considerable extent of country. The continued heavy rains during the first half of the month caused freshets in western Pennsylvania and eastern Ohio. The Ohio River rose above the danger-line at Cincinnati, Ohio, on the 25th, and at Louisville, Ky., on the 26th, and on the 28th it was 5.7 feet above the danger-line at Cincinnati, and 7.6 feet above the danger-line at Louisville. Navigation and railroad traffic were interfered with at Cincinnati by the flood, and the river overflowed its banks and flooded cellars at Louisville. During the latter part of the month great damage was caused in west-central Kentucky by the overflow of the Green River. In the vicinity of Findlay and Lima, Ohio, swollen streams caused great damage to railroad tracks and bridges. The Tennessee River and the creeks in Tennessee overflowed their banks, and the lower part of Chattanooga, Tenn., was flooded. Damage was caused near Waco, Tex., by overflowing streams. At Fort Verde, Ariz., the Verde River reached the highest point

known at that place on the 21st, drowning cattle and washing out irrigating ditches, and a large area of the Gila Valley was under water during the latter part of the month, flooding sections which had been considered safe from inundation, and severely damaging irrigating canals. On the 22d a large storage dam built across the Hassayampa River about thirty miles above Wickenburg, Ariz., gave way under pressure of floods caused by heavy rains and melting snow, causing loss of life and destroying considerable property.

STAGE OF WATER IN RIVERS AND HARBORS.

The following table shows the danger-points at the several stations; the highest and lowest water during February, 1890, with the dates of occurrence and the monthly ranges:

Heights of rivers above low-water mark, February, 1890 (in feet and tenths).

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
<i>Red River:</i>						
Shreveport, La.	29.9	28	20.5	13	17.9	2.6
<i>Arkansas River:</i>						
Fort Smith, Ark. ...	22.0	5, 16	11.8	2	5.3	6.5
Little Rock, Ark. ...	23.0	28	19.0	2	9.5	9.5
<i>Missouri River:</i>						
Ft. Buford, N. Dak.*	21.0	12	8.0	28	0.7	7.3
Kansas City, Mo. ...	21.0					
<i>Mississippi River:</i>						
Saint Paul, Minn.*	14.5					
La Crosse, Wis.*	24.0					
Dubuque, Iowa* ...	16.0					
Davenport, Iowa ...	15.0	13	2.8	24	1.0	1.8
Keokuk, Iowa ...	14.0	10	2.9	26	0.3	2.6
Saint Louis, Mo. ...	32.0	8	11.4	1	8.3	3.1
Oairo, Ill.	40.0	17	41.8	7	33.1	8.7
Memphis, Tenn. ...	40.0	1, 2	34.1	9, 10	29.4	4.7
Vicksburg, Miss. ...	41.0	28	46.2	1	42.0	4.2
New Orleans, La. ...	13.0	27, 28	15.7	1	13.4	2.3
<i>Ohio River:</i>						
Pittsburgh, Pa.	22.0	21	18.8	14	6.7	12.1
Parkersburg, W. Va. ...	38.0	23	26.2	1	11.5	14.7
Cincinnati, Ohio ...	50.0	28	55.7	1	22.3	33.5
Louisville, Ky.	25.0	28	32.6	1	9.9	22.7
<i>Cumberland River:</i>						
Nashville, Tenn. ...	40.0	28	43.4	23	12.6	30.8
<i>Tennessee River:</i>						
Chattanooga, Tenn. ...	33.0	28	34.8	22	7.1	27.7
Knoxville, Tenn. ...	29.0	28	23.0	6	1.4	21.6
<i>Monongahela River:</i>						
Pittsburgh, Pa.	29.0	21	18.8	14	6.7	12.1
<i>Savannah River:</i>						
Augusta, Ga.	32.0	28	21.9	8	7.2	14.7
<i>Willamette River:</i>						
Portland, Oregon ...	15.0	5	28.7	28	1.3	27.4

*Frozen.

The above table shows that the Mississippi River was 1.8 foot above the danger point at Cairo, Ill., on the 17th; 0.1 foot above at Memphis, Tenn., on the 1st and 2d; 5.2 feet above at Vicksburg, Miss., on the 28th; and 2.7 feet above at

New Orleans, La., on the 27th and 28th. The Ohio River was 5.7 feet above the danger point at Cincinnati, Ohio, on the 28th, and 7.6 feet above at Louisville, Ky., on the same date. The Cumberland River was 3.4 feet above the danger point at

Nashville, Tenn., on the 28th. The Tennessee River was 1.8 foot above the danger point at Chattanooga, Tenn., on the 28th. The Willamette River was 13.7 feet above the danger point at Portland, Oregon, on the 5th.

○ ATMOSPHERIC ELECTRICITY.

○ AURORAS.

Sault de Ste. Marie, Mich., 14th: an auroral display was observed at 9.40 p. m., consisting of a well-defined arch of yellowish light which rose to about altitude 40°. The arch extended between north and northeast, and the maximum brilliancy of the aurora occurred at 10.50 p. m., after which the arch gradually disappeared, and at 11.20 p. m. the display had entirely vanished.

Marquette, Mich., 14th: an auroral display, consisting of a dark segment which rose about twenty-five degrees above the horizon, and also of an arch of pure white light which extended from northwest to northeast, was observed in the evening.

Auroras were observed during the month as follows: 1st, Orono, Me. 6th, Wapeton, N. Dak. 11th, Cresco, Iowa; Eastport and Orono, Me.; Leech Farm, N. Dak.; Webster, S. Dak. 13th, Orono, Me. 14th, Cresco, Iowa; Marquette and Sault de Ste. Marie, Mich.; Leech Farm, N. Dak.; Greenwood, Wis. 15th, Lewiston, Pa. 18th, Manitowoc, Wis. 20th, Montevideo, Minn.

○ THUNDER-STORMS.

The more severe thunder-storms of the month are described under "Local storms". East of the Rocky Mountains thunder-

storms were reported in the greatest number of states and territories, twenty-four, on the 25th; in twenty on the 24th; in sixteen on the 26th; in fifteen on the 18th; in fourteen on the 19th and 28th; in from five to eleven, inclusive, on the 3d, 4th, 6th, 7th, 8th, 13th, 14th, 17th, 20th, 23d, and 27th; and in from one to three, inclusive, on the 1st, 2d, 9th to 12th, 21st, 22d. The 5th, 15th, and 16th were the only dates on which no thunder-storms were reported east of the Rocky Mountains.

East of the Rocky Mountains thunder-storms were reported on the greatest number of dates, twelve, in Louisiana, Mississippi, Pennsylvania, and Texas; on eleven dates in Tennessee; on ten dates in Alabama, Arkansas, and Illinois; on from five to nine dates, inclusive, in Florida, Georgia, Indiana, Kentucky, Maryland, Michigan, Missouri, New Jersey, New York, North Carolina, Ohio, South Carolina, Virginia, and West Virginia; and on one or two dates in Connecticut, District of Columbia, Indian Territory, Iowa, Kansas, Massachusetts, Minnesota, Rhode Island, and Wisconsin. In states and territories east of the Rocky Mountains other than those named, no thunder-storms were reported. The only states west of the Rocky Mountains reporting thunder-storms were: California, 16th and 19th; New Mexico, 6th and 26th; and Utah 26th.

MISCELLANEOUS PHENOMENA.

○ HALOS.

Solar and lunar halos were reported in New England and the middle Atlantic states on twenty-five dates. On twenty-four dates rain or snow fell in that region on the dates for which halos were reported; on twenty-two dates on the second day; and on twenty dates on the third day following the halos. In the south Atlantic states halos were reported on fifteen dates. On thirteen dates rain fell on the dates for which halos were reported; on ten dates on the second day; and on eight dates on the third day following the halos. In the Lake region halos were reported for twenty-two dates. On nineteen dates rain or snow fell on the dates for which halos were reported; on seventeen dates on the second day; and on fifteen dates on the third following the halos. In the Mississippi and Ohio valleys halos were reported on twenty-three dates. On eighteen dates rain or snow fell on dates for which the halos were reported; on seventeen dates on the second day; and on seventeen dates on the third day following the halos. In the Gulf states halos were reported on eight dates. On eight dates rain fell on the dates for which the halos were reported; on five dates on the second day; and on seven dates on the third day following the halos. In the Rocky Mountain and plateau regions halos were reported on eight dates. On six dates rain or snow fell on the days for which the halos were reported; on six dates on the second day; and on six dates on the third day following the halos. In the Missouri Valley halos were reported on twenty dates. On sixteen dates rain or snow fell on the days for which halos were reported; on thirteen dates on the second day; and on ten dates on the third day following the halos. On the Pacific coast halos were reported on seventeen dates. On fourteen dates rain fell on the dates for which halos were reported; on fourteen dates on the second day; and on fourteen dates on the third day following the halos.

The above statement shows that in New England and the middle Atlantic states 96 per cent. of the halos were attended

by rain or snow in the regions referred to on the same date; 89 per cent. were followed on the second day, and 80 per cent. on the third day by rain or snow. In the south Atlantic states 87 per cent. of the halos were attended by rain on the same date; 67 per cent. were followed on the second day, and 53 per cent. on the third day by rain. In the Lake region 86 per cent. of the halos were attended by rain or snow on the same day; 77 per cent. were followed on the second day, and 68 per cent. on the third day by rain or snow. In the Mississippi and Ohio valleys 78 per cent. of the halos were attended by rain or snow on the same day, and 74 per cent. were followed on the second and third days by rain or snow. In the Gulf States 100 per cent. of the halos were attended by rain on the first day; 63 per cent. were followed on the second day, and 87 per cent. on the third day by rain. In the Rocky Mountain and plateau regions 78 per cent. of the halos were attended by rain or snow on the same day, and 78 per cent. were followed on the second and third days by rain or snow. In the Missouri Valley 80 per cent. of the halos were attended by rain or snow on the same day; 65 per cent. were followed on the second day, and 50 per cent. on the third day by rain or snow. On the Pacific coast 82 per cent. of the halos were attended by rain or snow on the same day, and 82 per cent. were followed on the second and third days by rain or snow. It is also shown that in New England and the middle Atlantic states 64 per cent. of the halos occurred in the eastern quadrants of low pressure storms, and 36 per cent. following the passage of areas of low pressure or within areas of high pressure. In the south Atlantic states 53 per cent. of the halos occurred in the eastern quadrants and 47 per cent. in the western quadrants of low pressure storms. In the Lake region 59 per cent. of the halos occurred in the eastern quadrants and 41 per cent. in the western quadrants of low pressure storms. In the Mississippi and Ohio valleys 56 per cent. of the halos occurred in the eastern quadrants and 44 per cent.